

ADVANCED MACHINING TOWARDS IMPROVED MACHINABILITY OF DIFFICULT-TO-CUT MATERIALS

Edited by:

A.K.M. Nurul Amin (Chief Editor)

Dr. Erry Yulian Triblas Adesta

Dr. Mohammad Yeakub Ali



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Chapter 12

Application of Permanent Electromagnet for Chatter Control in End Milling of Medium Carbon Steel

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1.0 INTRODUCTION

In machining process, the machine, cutting and the work piece are integrated to form structural systems which create a dynamic characteristic. Soliman, Ismail [1] observed that vibration can be divided into three types, free vibrations, force vibrations and self-excited vibrations (chatter). As in this project, the focus is more on the chatter that contribute for the tool wear during the machining of material under certain conditions of cutting processes. Chatter is an abnormal tool behavior which it is one of the most critical problems in machining process and must be avoided to improve the dimensional accuracy and surface quality of the product. Chatter is originated from the disturbance that occur in the cutting zone to lack of homogeneity between surface of the work piece, change in the types chips being produced or change in the frictional conditions at the tool-chip interface influenced by cutting fluids being used. The forces then strain the structure elastically and can cause a relative displacement between tool and work piece. The theory of chatter quoted by Budak, E, and Altintas Y. [2,3] suggested the chatter as a coupling vibration phenomenon between the workpiece and tool. Wiercigroch M. and Budak [4] states that mode of coupling resulted from the vibration in the thrust force direction generate vibration in the thrust and cutting force direction. However, Amin and Anayet [5] found that the root cause of chatter lies in the coincidence of the frequency of instability of chip formation with one of the natural frequencies of the machine-spindle-tool system components during end milling machining operation.

Kim et al. [6] explained that most of the drawbacks that come from chatter are excessive tool wear, noise, tool breakage, and deterioration of the surface quality. Moreover chatter also results in reduced material removal rate (MRR), increased costs in terms of time, materials and energy, as well as the environmental impact of dumping non-valid final parts and having to repeat the manufacturing process as quoted from Quintana et al. [7].